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# LONG-TERM RETENTION OF PLASTIC COLLARS ON CANADA GEESE

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**Abstract:** Analysis of retrapped Canada geese (*Branta canadensis maxima*) at Seney National Wildlife Refuge showed that only 30 percent of the birds retained flexible plastic collars after 6 years. Retention was higher among females than among males. Fading, brittleness, and loss of the number-letter combination of the collars are discussed.

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During a study of limiting factors and behavior of Canada geese at the Seney National Wildlife Refuge between 1963 and 1965, 518 geese were marked with flexible plastic collars (Sherwood 1966a). Although the study officially ended in 1965, many of the geese survived long past that date and some of the collars were retained for several more years.

The purpose of this paper is to report on the long-term retention rates of these collars and to describe the condition of the collars after up to 6 years of use.

The author thanks D. H. Johnson, of the Northern Prairie Wildlife Research Center, for his assistance in the statistical analysis.

## MATERIALS AND METHODS

Sherwood (1966b), who conducted the behavior study, designed the collars; their construction has been described in detail in an earlier paper. Each collar was 2.5 inches tall and had a number-letter combination routed into the plastic and painted with black lacquer.

Orange collars were used in 1963, white in 1964, and yellow in 1965. Ends of the collars were not bonded with adhesive, so a birds could pull the collar off if it became caught.

Determination of retention rates was made through the analysis of retrap data

for the years 1966-69. When a collared or otherwise color-marked goose was re-trapped, the marking was recorded on a field sheet. A check of band numbers of all retrapped geese was made to determine those birds that had originally been marked with collars. Retention rates were determined by comparing collars still in place with collars lost for each age-group of collars.

Only birds trapped were used in determining the retention rates. This has resulted in a smaller sample, but has eliminated the bias of field observations towards marked birds.

## RESULTS AND DISCUSSION

During the 4-year period, a total of 194 retraps was made, 105 with the collars in place and 89 with the collars missing. A breakdown of the recoveries by the number of years since collar placement and by sex is given in Table 1.

The smaller number of retraps of the 1- and 2-year-old collars is because orange collars were already 3 years old and white collars 2 years old during the first year of data collection in 1966. The same is true in the older groups where only orange collars were present in the 6-year-old group and orange and white collars in the 5-year-old group.

The data in Table 1 were analyzed to determine whether the sex of the bird and number of years after placement had an

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Table 1. Collar retention rates of Canada geese at Seney National Wildlife Refuge.

YEARS AFTER COLLAR PLACEMENT	Sex	NUMBER OF RETRAPES		RETENTION RATE (percent)
		Collars On	Collars Off	
1	M	11	5	69
	F	15	3	83
	Total	26	8	76
2	M	12	6	67
	F	19	8	70
	Total	31	14	69
3	M	15	13	54
	F	14	19	42
	Total	29	32	48
4	M	4	9	31
	F	7	9	44
	Total	11	18	38
5	M	2	5	29
	F	3	5	38
	Total	5	10	33
6	M	0	3	0
	F	3	4	43
	Total	3	7	30

effect on the retention of the collars. The arcsine transform of the proportion retained was fit to a linear model using weighted least squares (Anscombe 1948). The resultant values showed a significantly ( $P < 0.05$ ) higher retention rate for females and a significant effect on retention by the number of years after placement.

The retention rates for the 1- and 2-year-old groups are somewhat lower than the 88 and 82 percent reported by Sherwood (1966*b*) and the 90 and 80+ percent reported by Ballou and Martin (1964). No rates for older collars are available other than Ballou and Martin's (1964) comment that "Some geese wore collars for at least six years."

These earlier determinations of retention rates were based, at least partially, on field observations and band recoveries and it is probable that some birds that had lost their collars were overlooked. Those birds losing

both their collars and their service bands would have also been overlooked in this study, but this number of birds is small and would not greatly affect the retention rates.

The significantly higher retention of collars by females was supported by field observations of marked birds. Of the 518 collars placed, 262 were on males and 256 (49 percent) on females. Observations of 24 collared geese in 1969 revealed that 20 were females and only 4 were males. Similar observations in 1968 revealed that 21 out of 28 collars seen were on females.

Part of this unbalance in field observations can be attributed to a higher mortality rate for males than females in the Seney flock. Sherwood (1966*a*) found that of yearlings and older geese in the Seney flock 43 percent were males and 57 percent females. He offered evidence that males were being shot more heavily than females as one possible explanation for the unbalanced sex ratio. Dispersal of males to other flocks would also account for some of the difference in field observations. An unbalanced mortality rate and dispersal do not explain the different retention rates by sex in Table 1, however, where the rates are independent of the sex ratio of the flock, of field observations, of mortality rates, and of the number of collars originally placed.

Sherwood (1966*b*) reported two principal causes of collar loss. The first, collars slipping over the smaller heads of goslings, was solved by marking the birds after they were 2 months old. The second, collars pulling off on wire duck traps, has largely disappeared. Wire duck traps are still used at Seney Refuge, but only one collar was found on a trap in 1968 and none in 1969. Those birds that tend to feed under the traps have in large part already lost their collars.

The major cause of the collar loss after the first 2 or 3 years from placement ap-

pears to be breakage as the collars become older and more brittle. Canada geese do not chew the collars as vigorously as blue geese (*Chen caerulescens*) (MacInnes et al. 1969), but even the slightest disturbance to a brittle collar may cause it to break. Inspection of the older collars on retrapped birds in 1969 revealed that most were worn thin and would crack easily. Some were observed with pieces broken out. Breakage usually occurred along the routed number-letter combination, a natural weak point.

In addition to becoming brittle, many of the collars faded considerably over the years. Orange collars were still recognizable, but white and yellow were often difficult to tell apart. White collars became stained by the water and closely resembled the faded and stained yellow ones. It is recommended that greater differences in color be chosen to fully utilize the long-range benefits of a color marking investigation.

The number-letter combination also faded or disappeared entirely on many of the collars. As indicated by Sherwood (1966b), epoxy paint is more durable than the black lacquer used for the Seney collars.

Retention of the collars over a period of years provided opportunities to acquire information in addition to that gained in the original study at Seney Refuge. For instance, there were several relatively old birds with collars that provided an excellent opportunity to observe behavior of the senior members of the flock. Among those observed in 1970 were A-1 orange, a female at least 17 years old; P-1 orange, a female at least 12 years old; and J-6 orange, an 11-year-old female.

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